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The role of the number of characters in distinguishing taxa in taxonomic investigations performed by the dendrite method

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Abstract

The author presents a new conception of distinguishing taxonomic units, while taking into account a precise class of characters. It is shown on the taxonomy of species of *Delia* Dum., *Spergula* L., and *Spergularia* Presl., growning in Poland and based on the interpretation of the dendrite in the author's taxonomic investigations.

INTRODUCTION

Taxonomic investigations carried out by the dendrite method (Wrocław Taxonomy), allow the arrangement of material in the form of a dendrite in the best possible way.

The taxonomic interpretation of the dendrite, in spite of a methodical solution (K o w a l 1965), still arouses some doubts, as it is based on magnitudes of taxonomic difference between the investigated "individuals", the magnitudes of this taxonomic difference being dependent on the number of dissimilar characters that have been found in the examined "individuals". In agreement with recent views on taxonomy various characters should be used in building a system, and the more extensively all characters distinguishing the "individuals" included in the newly formed system are used, the better it will be.

The inconsistency between such a view on the problem of building a system (in investigations done by the dendrite method) and the interpretation of the dendrite proposed by the author (1965) was presented extensively by K o z ł o w s k i (1969) in his paper on the taxonomy of the genus *Cytisus*. Dealing with this genus K o z ł o w s k i arranged a table of characters of the investigated species, as: morphologic, anatomic, carpologic and phytochemical ones, and next he calculated the taxonomic differences of the various characters, and drew the dendrites.

It was then found that when the range of characters is wider the taxonomic differences increase, and thus the "smallest differences", used in building dendrites grow, too; very often they do not change the position of the given "individual" in the dendrite, but only change the taxonomic rank of the latter. In such a case the interpretation of dendrite according to principles proposed by the author (1965) has become problematic, because "individuals" of the rank of variety or species from the first dendrite, drawn according to taxonomic differences in morphologic characters of plants, grow to the rank of genus or family in the succeeding dendrites, drawn on the basis of increased differences caused by adding further characters.

It is clear that in such a situation the interpretation of a dendrite according to principles proposed by the author (1965) becomes problematic, as increasing the number of characters in the way described above leads us astray. At the same time we have to ask the question whether the conception accepted up to the present, and referring to the building of a system based on the greatest possible number of various characters, has been right, or whether the magnitude of the taxonomic difference has been a false criterion.

To answer these questions we have to remember the assumptions of the dendrite method and compare them with those of traditional taxonomy. The basis of the dendrite method is a precisely calculated magnitude of the taxonomic difference between investigated "individuals", and on its basis the "individuals" may be compared. Traditional (intuitive) taxonomy, taking the same number of characters, chooses some of them and ascribes to them a greater diagnostic or phylogenetic value, thus forming a system "by intuition". As the examined "individuals" cannot be compared in a precise way, the personal judgment of the investigator, i.e., his intuition, becomes decisive. Such personal opinion of an experienced taxonomist is, without doubt, greatly objective and precise, but it is not based on methodical criteria, which should be used. And there is still another question — what solution should be applied to keep genuineness of the distinguished taxonomic units without giving up methodical criteria based on the magnitude of the taxonomic difference?

THE PROBLEM OF THE NUMBER OF CHARACTERS NECESSARY FOR DISTINGUISHING TAXONOMIC UNITS

In traditional taxonomy taxonomic units are distinguished, essentially on the basis of stating differences in one, two or three characters. Of course, we are concerned here with units of the lowest rank. With

regard to units of higher rank there is no closely defined number of separate characters, and then the examiner's intuition is a great help.

In the principles of dendrite interpretation proposed by the author (1965), the magnitude of taxonomic difference defines the rank of the taxonomic unit. As the number of characters, used in calculating this taxonomic difference, plays an important role, it should be limited in order to get real and acceptable results. This limitation should not however, affect precision in defining characters, or leave too great a freedom in their choice, as the methodical interpretation of dendrite and the method itself would loose their objectivity. We have to accept objective criteria when limiting the number of characters, used to draw the dendrite.

On the basis of achievements of taxonomy up till now, we may accept as the rule for limiting the number of characters, such kinds or classes of characters that are based on their diagnostic values singled out in taxonomy.

The classes of characters distinguished in recent taxonomy of plants may be divided as follows:

A — morphological characters of plants
B — anatomical characters of plants
C — morphological characters of fruit and seed
D — anatomical characters of fruit and seed
E — embriological characters
F — physiological characters (phytochemical)
G — ecological characters
H — genetical characters.

The order of classes given here is rather practical and not genetic, as in the genetic arrangement a contrary order should be accepted. The number of classes of characters is probably not complete, but it illustrates sets of characters, used in taxonomy at present.

When we accept the above classes of characters as binding, we get an objective basis for limiting the number of characters, and thus we decrease the taxonomic difference, as taxonomic examinations should follow strictly defined classes of characters. In the intuitive method there are no such limitations.

THE PROBLEM OF DISTINGUISHING TAXONOMIC UNITS

The principles of distinguishing taxonomic units, based on a precisely defined class of characters will be considered on the example of species of the genera *Delia* Dum., *Spergula* L. and *Spergularia* Presl., growning in Poland for all of which a table of distinctive characters has been drawn in the paper: "A simple way of finding linked and antagonistic

characters by means of the table of characters used in the dendrite method". The characters distinguishing the examined species, compiled in this table, belong to the three, formerly mentioned classes, i.e.:

A — morphological characters of plants, Nos 1 - 89

C — morphological characters of fruit and seed, Nos 90 - 163

D — anatomical characters of fruit and seed, Nos 164 - 181

Taking these characters into account the author calculated the taxonomic differences between the species of the mentioned genera and arranged them in Czekanowski's table. To illustrate the problem of distinguishing taxonomic units better, I arranged, in addition, in separate Czekanowski's tables, the differences estimated according to the different classes of characters.

By means of Czekanowski's tables the author drew the shortest dendrites, as well as graphs of distances from typical species within the genera, separately for the different classes of characters. The graphs are given beside the dendrites as the latter themselves do not indicate the relations within taxonomic units.

A dendrite shows the mutual position of the various "individuals" in respect to one another (species in our example), in the examined set, with regard to the greatest similarity, i.e., the smallest taxonomic differences.

The graph illustrates the relations (taxonomic differences) between the "typical species" and other species of the examined set, arranged around it and forming a taxonomic unit with it.

The herbarium specimen described and named by the investigator (the abbreviation of the latter's name is placed beside that of the specimen), is considered as typical specimen "typical individual" in traditional taxonomy. For taxonomic units higher than species the most representative lower units included in the taxon are regarded as typical.

Such a typical "individual" (e.g., specimen, species, etc.) may be also chosen by means of the dendrite method (K o w a l 1961). The choice is made by summing up the various columns of Czekanowski's table, and then a "typical individual" will be the one (specimen, species, etc.) that shows the smallest value of the sum of taxonomic differences within all other individuals of the examined set.

In case of the species of the genera *Delia*, *Spergula*, and *Spergularia*, growning in Poland the "typical individuals" have been marked out by means of sums in Czekanowski's tables, in different classes of characters for three groups of species, i.e., collective species *Spergula arvensis* I - V; species of the genus *Spergula* VI - VII, and species of genus *Spergularia* VIII - XII. As it appears from the calculations given in these tables, the "typical species" in the given set may be the same, or different, for different classes of characters.

On the basis of Czekanowski's tables the author drew the shortest dendrites, and "distance" graphs from typical species. Let us try to interpret these dendrites and graphs.

Dendrite 1 and graph 1a illustrate the best taxonomic arrangement of our set of species of the genera *Delia, Spergula* and *Spergularia* made up on the basis of all characters of the previously mentioned table of characters that belong to three classes: A (morphological characters of plants), C (morphological characters of fruit and seeds), and D (anatomical characters of fruit and seeds.)

When the principles proposed by the author (1965) are taken as the basis of interpretation of this dendrite and graph, it can be seen that the taxonomic difference in the dendrite (between species included in the genus *Spergula,* i.e., *S. pentandra* (VI) and *S. vernalis* (VII) and the others, i.e., *S. arvensis* (I), *S. linicola* (II), *S. maxima* (III), *S. sativa* (IV), and *S. vulgaris* (V) amounts to 47,5 and this fact classes them to the rank of separate genera. The taxonomic difference, however, between species of the genera *Spergula* (I - VII) and *Spergularia* (VIII - XI) is 74,8 in the dendrite, and this qualifies them for the rank of separate subtribes. The same is true for species included in the genus *Spergularia* (VIII - XI) and *Delia* (XII) which, by their rank defined on the ground of the magnitude of taxonomic difference, greatly exceed the rank of genus.

In graph 1a, showing the relations between species typical of our genera and all the others, the differences are much greater, as in the dendrite our typical species do not come together.

Dendrite 2 and graph 2a show the smallest taxonomic differences among the genera *Delia, Spergula,* and *Spergularia,* within solely morphological characters of plants (class A). The greatest taxonomic differences found here have the rank of subgenus (36,8 — dendrite), or genus (41.4 — graph), and divide the species of the genera mentioned above into two groups. One includes the species of the genus *Spergula,* the other *Spergularia* and *Delia.* Within the genus *Spergula* the species *S. pentandra* (VI) and *S. vernalis* (VII) differ taxonomically (24) from other species (I -V) that form the collective species *S. arvensis,* qualifying the two groups for the rank of separate sections. Within the group including the species *Delia* and *Spergularia* the typical species is *Spergularia echinosperma* (VIII). Other species show however, such remarkable differences that they may be considered as subgenera i.e., *Delia segetalis* (XII) and *Spergularia marginata* and *S. salina,* in the subsection *S. rubra.*

This division is very similar to the intuitive division accepted now-days based to a considerable extent on morphological characters of plants. It can be objected that the ranks of distinguished taxonomic units are

unreal, as they are closely defined and comparable and therefore their rank is much more precisely defined than in traditional taxonomy.

In a similar way as for morphological characters of plants (class A), dendrite (4) and graph (4a) are formed for morphological characters of fruit and seeds (class C). There are, of course, somewhat different magnitudes of taxonomic differences among the species, but generic groupings, as well as lower ones, remain fundamentally the same, as in the previous dendrites and graphs. Taxonomic differences here are of such an order that on their basis a taxonomic division distinguishing not only species but also sections, subgenera and genera may be established. Thus it can be stated that morphological characters of fruit and seeds (class C) are wholly sufficient to form the taxonomy of the discussed species.

Within the anatomical characters of fruit and seeds (class D) — dendrite 5 and graph 5a — taxonomic differences are very slight. If this class were united with class C (morphological characters of fruit and seed) taxonomic differences would increase only slightly (dendrite 3 and graph 3a), so that no essential changes would be introduced into the interpretation of the dendrite. Such mixing of classes of characters is not correct, however, and should not be applied, as each class of characters has an intrinsic and definite taxonomic value.

CONCLUSIONS

In taxonomic interpretations carried out by the dendrite method it is a very important problem to distinguish taxonomic units. The following conclusions may be presented and new methodical solutions proposed.

1. The magnitude of the taxonomic difference (which is the result of examinations by the dendrite method), is dependent on the number of separate characters, yet it is an objective criterion allowing the comparison of "individuals" of the examined set, and distinguishing taxonomic units thanks to it.

2. As the magnitude of the taxonomic difference depends on the number of characters and, when this difference is calculated, the use of all known (or distinguished) characters would lead the investigator astray — the number of characters should be limited to only these which help to distinguish taxa. Accepting as a basis the distinguished kinds or classes of characters in taxonomy up till now, we may in an objective way, limit the number of characters used in investigations, while the taxonomic units may be distinguished by means of actual classes of characters.

3. The classes of characters distinguished in taxonomy at present are the following:,

A — morphological characters of plants;
B — anatomical characters of plants;
C — morphological characters of fruit and seeds;
D — anatomical characters of fruit and seeds;
E — embryological characters;
F — physiological (phytochemical) characters;
G — ecological characters;
H — egenetical characters.

With the development of our knowledge of plants the number of classes of characters may, of course, be increased.

The arrangement of classes given here is rather practical, as, at present, manly characters of class "A" are applied in taxonomy, even though the existence of most characters is conditioned and depends on genetic characters (class H).

In practice, however, at least at the present stage, the use of genetic characters would be very difficult, and even impossible, Therefore a taxonomist makes use of those characters that are easily accessible in his daily work, i.e., morphological characters of plants (A), morfological characters of fruit and seeds (C), and only when these cannot be distinguished he uses other classes of characters.

Characters are often interdependent in such a way, as, e.g., a given morphological character of a vegetative organ is conditioned by a closely defined anatomical structure. So, when characters of different classes get mixed, the characters will be often duplicated, and this causes an unjustified increase of the taxonomic difference.

The best solution would be to accept genetical characters as the basis, (the group of genes determining the existence of the given specimen) — but this is impracticable at the present stage, and therefore the taxonomist draws conclusions on genotype from the phenotype.

The previously given data referring to the dependence of taxonomic difference on the number of characters show that this principle of using definite classes of characters in taxonomy should be accepted. From the practical point of view class "A" (morphological characters of plants) should be put first, next "C" (morphological characters of fruit and seeds), and only then should others follow, depending on possible investigations and results at the scientist's disposal.

It should be stressed that it is not necessary to determine which class of characters is the most important, as all are significant in the same degree, when they show some differentiation. In order to distinguish taxonomic units it would be advisable to know the characters of all classes.

The determination of the taxonomic rank should be done on the ground of a closely defined class of characters, while the differences between "individuals" are various in different kinds of classes. Therefore to define the taxonomic rank of the given "individual", the class that shows the greatest, out of the smallest, taxonomic difference should be taken, because dendrites are built of the smallest taxonomic differences, and thus "individuals" resembling one another the most, i.e., differing the least, are found.

4. The differentiation of taxonomic units based on each class of characters should be done according to principles worked out for the dendrite method (K o w a l 1965). As a result of the above we shall be able to say in taxonomy that a given "individual" has the rank of "form", "variety", "species", etc. in the characters of class "A" (morphology of plants), or class "C" (carpological morphology), and others. In this way the apparent discrepancy between results of investigations done intuitively, and those obtained by applying a precise and objective method, (Wrocław Taxonomy), will disappear. The aim of introducing this method to taxonomy is not the formation of some quite new taxonomy, but the expression of the results of examinations, done up till now, in mathematical formulae (that is in the most general and objective, as well as verifiable form), and thus the results will become specifically important.

5. Taking into account all performed comparisons of applying different classes of characters to taxonomy by means of the dendrite method, shown on the species of the genera *Delia, Spergula* and *Spergularia* growing in Poland, it should be stated that very good divisions are achieved in characters of classes "A" and "C".

With regard to the existing conceptions of taxonomic division of species belonging to those genera, the following remarks emerge in the light of investigations done by the dendrite method:

a. within the genus *Spergula* two sections should be distinguished: 1) with the collective species *S. arvensis* (I - V) — (the species I - V have not got the rank of species), and 2) with the species *S. pentandra* (VI) and *S. verenalis* (VII);

b. the species *Delia segetalis* resembles to the genus *Spergularia*, and separating it into an individual genus seems to be wrong. Therefore the old name, *Spergularia segetalis* Fenzl should come into use again;

c. taxonomic differences among species of the genus *Spergularia* show that their differentiation is great, and some units lower than genera should be found for the species growing in Poland, namely of the rank of subgenera: I. *S. segetalis;* II. *S. salina;* III *S. marginata,* and IV *S. echinosperma* and *S. rubra.* Within the subgenus IV there would

be two sections: 1. with the species *S. echinosperma,* and 2. with the species *S. rubra.* "Typical" species for the genus *Spergula* in the class of characters "A" is *S. sativa,* and for the species *Spergularia* is *S. echinosperma.*

For the collective species *Spergula arvensis* a better division is achieved in characters of class "C". A typical species here is *S. arvensis.* But even here amendments must be made in the taxonomic ranks. Thus *S. linicola, S. sativa* and *S. vulgaris* are subspecies to *S. arvensis,* while *S. maxima* is only a subvariety. The taxonomy of the collective species *S. arvensis* is in characters of class "C" as follows:

S. arvensis L.
S. — L. subsp. I *linicola* (Boreau)
S. — L. subsp. II *sativa* (Boenn)
S. — L. subsp. III *vulgaris* (Boenn)
S. — L. subvar. *maxima* (Weihe)

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COMMEN

TO CZEKANOWSKI'S

1. Roman numerals designate the following species:

I. *Spergula arvensis* L.
II. — *linicola* Boreau
III. — *maxima* Weihe
IV. — *sativa* Boenn.
V. — *vulgaris* Boenn.
VI. — *pentandra* L.

2. Arabic numerals in squares of Czekanowski's tables designate the value of systematic difference

The Czekanowski table containing the systematic difference between species

	I	II	III	IV	V	VI	VII
I		13,8	10,4	12,6	12,6	53,1	54,2
II	13,8		18,8	11,4	23,6	59,6	58,7
III	10,4	18,8		22,2	9,2	51,8	53,3
IV	12,6	11,4	22,2		16,2	52,4	56,8
V	12,6	23,6	9,2	16,2		49,6	47,5
VI	53,1	59,6	51,8	52,4	49,6		15,6
VII	54,2	58,7	53,3	56,8	47,5	15,6	
VIII	90,6	84,9	97,3	86,3	96,5	94,1	89.—
IX	83,9	74,8	89,2	76,4	86,—	78,9	74,8
X	95,2	99,—	96,2	96,5	95,7	90,1	86,7
XI	81,3	76,—	88,9	77,1	86,—	80,5	81,1
XII	91,4	96,1	95,0	93,8	94,5	82,9	83,6

The table of Czekanowski containing the systematic differences between

	I	II	III	IV	V	VI	VII
I		1,8	1,2	0,8	0,8	24,2	26,8
II	1,8		3,—	1,—	1,—	25,—	26,4
III	1,2	3,—		2,—	2,—	24,6	27,6
IV	0,8	1,—	2,—		0,—	24,—	26,—
V	0,8	1,—	2,—	0,—		24,—	26,4
VI	24,2	25,—	24,6	24,—	24,—		7,4
VII	26,8	26,4	27,6	26,4	26,4	7,4	
VIII	41,4	43,5	42,5	42,5	42,5	41,5	38,9
IX	43,1	41,4	42,6	41,—	41,2	42,—	38,6
X	44,2	46,5	45,6	45,1	45,1	45,1	42,1
XI	37,5	38,9	39,6	38,4	37,9	38,6	40,3
XII	38,—	39,—	40,—	40,—	40,5	36,8	37,8

TARY TO

TABLES AND TO GRAPHS

VII. *Spergula vernalis* Willd.
VIII. *Spergularia echinosperma* Čel.
IX. — *marginata* (DC) Kittel
X. — *rubra* (L.) Presl
XI. — *salina* Presl
XII. *Delia segetalis* Dum. (=*Spergularia segetalis* Fenzl.)

between the two compared species

I–XII, calculated on the base of characters of categories A, C and D.

					Sum for numbers		
VIII	IX	X	XI	XII	I–V	I–VII	VIII–XII
90,6	83,9	95,2	81,3	91,4	49,4	156,7	
84,9	74,8	99,0	76,0	96,1	67,6	186,1	
97,3	89,2	96,2	88,9	95,0	60,6	165,7	
86,3	76,4	96,5	77,1	93,8	62,4	171,6	
96,5	86,–	95,7	86,–	94,5	61,6	158,7	
94,1	78,9	90,1	80,5	82,9		282,1	
89,–	74,8	86,7	81,1	83,6		286,1	
	65,7	36,6	61,3	51,9			215,5
65,7		73,9	33,3	88,–			260,9
36,6	73,9		73,7	44,7			228,9
61,3	33,3	73,7		82,2			250,5
51,9	88,–	44,7	82,2				266,8

species I – XII calculated on base of characters of category A.

					Sum for numbers		
VIII	IX	X	XI	XII	I–V	I–VII	VIII–XII
41,4	43,1	44,2	37,5	38,–	4,6	55,6	
43,5	41,4	46,5	38,9	39,–	6,8	58,2	
42,5	42,6	45,6	39,–	40,–	8,2	60,4	
42,5	41,–	45,1	38,4	40,–	3,8	53,8	
42,5	41,2	45,1	37,9	40,5	3,8	54,2	
41,5	42,–	45,1	38,6	36,8		129,2	
38,9	38,6	42,1	40,3	37,8		141,0	
	33,3	18,–	30,5	31,9			113,7
33,3		31,9	24,1	41,–			130,3
18,–	31,9		33,1	32,7			115,7
30,5	24,1	33,1		36,6			124,3
31,9	41,–	32,7	36,6				412,2

The table of Czekanowski containing the systematic differences between

	I	II	III	IV	V	IV	VII
I		12,—	9,2	11,8	11,8	28,9	27,4
II	12,—		15,8	10,4	22,6	34,6	32,2
III	9,2	15,8		20,2	7,2	27,2	25,7
IV	11,8	10,4	20,2		16,2	28,4	30,4
V	11,8	22,6	7,2	16,2		25,6	21,1
VI	28,9	34,6	27,2	28,4	25,6		8,2
VII	27,4	32,3	25,7	30,4	21,1	8,2	
VIII	49,2	41,4	54,8	43,8	54,—	52,6	50,—
IX	40,8	33,4	46,6	35,4	44,8	36,9	36,2
X	50,—	52,5	50,6	51,4	50,6	45,—	44,6
XI	43,8	37,1	49,9	38,7	48,1	41,9	40,8
XII	53,4	47,1	55,—	53,8	54,—	46,1	45,8

The table of Czekanowski containing the systematic differences between

	I	II	III	IV	V	VI	VII
I		11,6	8,8	11,2	11,2	24,3	22,8
II	11,6		15,8	9,4	21,6	29,6	27,3
III	8,8	15,8		19,2	6,2	22,2	20,7
IV	11,2	9,4	19,2		16,2	24,4	26,4
V	11,2	21,6	6,2	16,2		21,6	17,1
VI	24,3	29,6	22,2	24,4	21,6		8,2
VII	22,8	27,3	20,7	26,4	17,1	8,2	
VIII	41,6	33,4	46,8	36,8	47,—	45,6	43,1
IX	30,2	22,4	35,6	25,4	34,8	28,9	28,2
X	42,4	44,5	42,6	44,4	43,6	28,—	37,6
XI	31,2	24,1	36,9	26,7	36,1	31,9	38,8
XII	43,8	57,1	45,—	44,8	45,—	37,1	36,8

The table of Czekanowski containing the systematic differences between

	I	II	III	IV	V	VI	VII
I		0,4	0,4	0,6	0,6	4,6	4,6
II	0,4		0,—	1,—	1,—	5,—	5,—
III	0,4	0,—		1,—	1,—	5,—	5,—
IV	0,6	1,—	1,—		0,—	4,—	4,—
V	0,6	1,—	1,—	0,—		4,—	4,—
VI	4,6	5,—	5,—	4,—	4,—		0,—
VII	4,6	5,—	5,—	4,—	4,—	0,—	
VIII	7,6	8,—	8,—	7,—	7,—	7,—	7,—
IX	10,6	11,—	11,—	10,—	10,—	8,—	8,—
X	7,6	8,—	8,—	7,—	7,—	7,—	7,—
XI	12,6	13,—	13,—	13,—	12,—	10,—	10,—
XII	9,6	10,—	10,—	9,—	9,—	9,—	9,—

species I—XII calculated on base of characters of categories C and D.

					Sum for numbers		
VIII	IX	X	XI	XII	I—V	I—VII	VIII—XII
49,2	40,8	50,—	43,8	53,4	44,8	101,1	
41,4	33,4	52,5	37,1	57,1	60,8	127,7	
54,8	46,6	50,6	49,9	55,—	52,4	105,3	
43,8	35,4	51,4	38,7	53,8	58,6	117,4	
54,—	44,8	50,6	48,1	54,—	57,8	104,5	
52,6	36,9	45,—	41,9	46,1		152,9	
50,1	36,2	44,6	40,8	45,8		145,1	
	32,4	18,6	30,8	20,—			101,8
32,4		42,—	9,2	47,—			130,6
18,6	42,—		40,6	12,—			113,2
30,8	9,2	40,6		45,6			126,2
20,—	47,—	12,—	45,6				124,6

species I — XII calculated on base of characters of category C.

					Sum for numbers:		
VIII	IX	X	XI	XII	I—V	I—VII	VIII—XII
41,6	30,2	42,4	31,2	43,8	42,8	89,9	
33,4	22,4	44,5	24,1	47,1	58,4	115,3	
46,8	35,6	42,6	36,9	45,—	50,0	92,9	
36,8	25,4	44,4	26,7	44,8	56,0	106,8	
47,—	34,8	43,6	36,1	45,—	55,2	93,9	
45,6	28,9	38,—	31,9	37,1		130,3	
43,1	28,2	37,6	30,8	36,8		122,5	
	25,4	18,6	21,8	18,—			83,8
25,4		35,—	7,2	38,—			105,4
18,6	35,—		31,6	10,—			95,2
21,8	7,2	31,6		34,6			95,2
18,—	38,—	10,—	34,6				100,6

species I — XII calculated on base of characters of category D.

					Sum for numbers		
VIII	IX	X	XI	XII	I—V	I—VII	VIII—XII
7,6	10,6	7,6	12,6	9,6	2,0	11,2	
8,—	11,—	8,—	13,—	10,—	2,4	12,4	
8,—	11,—	8,—	13,—	10,—	2,4	12,4	
7,—	10,—	7,—	12,—	9,—	2,6	10,6	
7,—	10,—	7,—	12,—	9,—	2,6	10,6	
7,—	8,—	7,—	10,—	9,—		22,6	
7,—	8,—	7,—	10,—	9,—		22,6	
	7,—	0,—	9,—	2,—			18,0
7,—		7,—	2,—	9,—			25,0
0,—	7,—		9,—	2,—			18,0
9,—	2,—	9,—		11,—			31,0
2,—	9,—	2,—	11,—				24,0

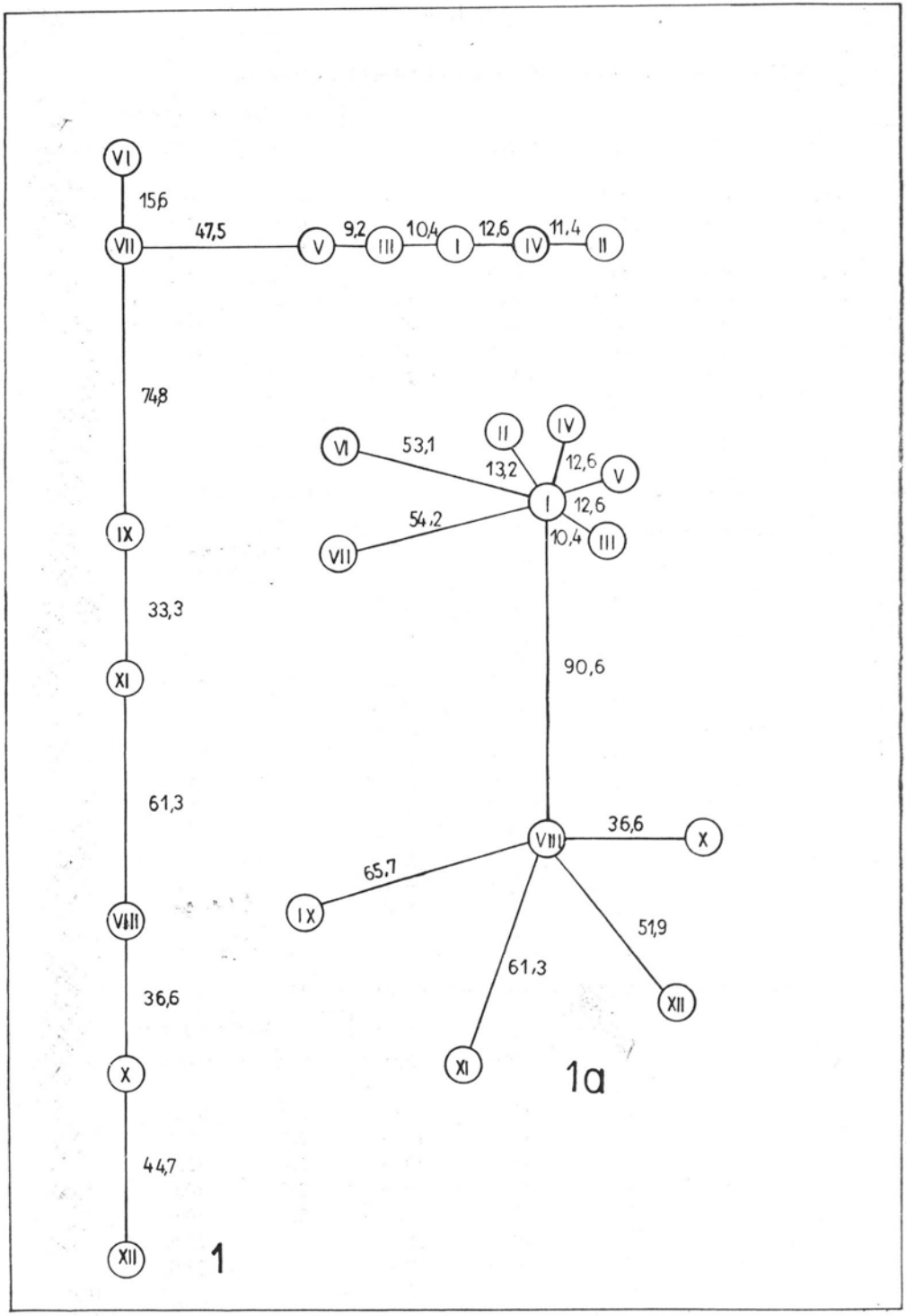

Fig. 1. Dendrite 1 and graph 1a

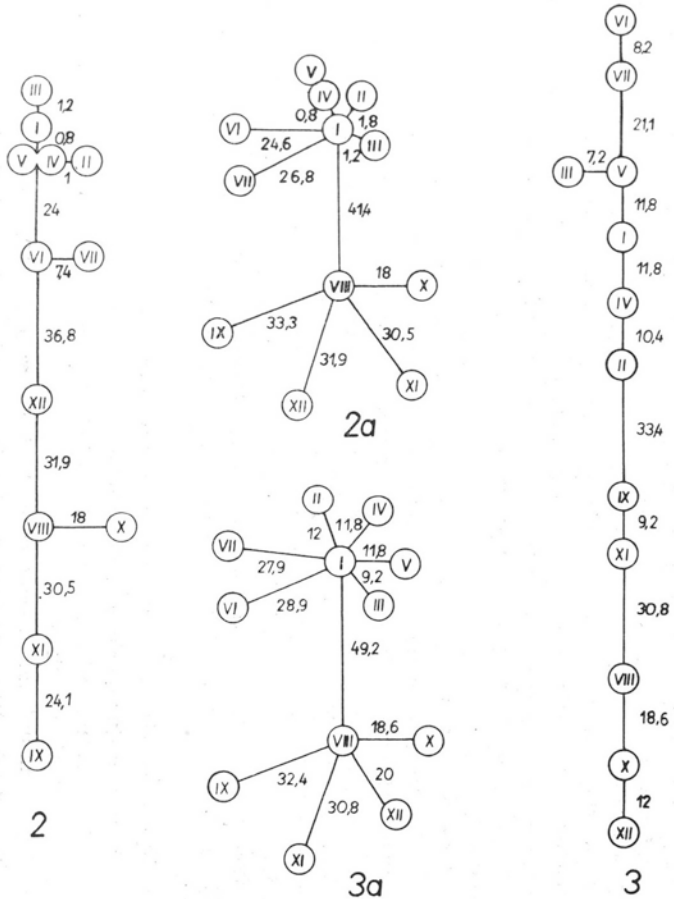

Fig. 2. Dendrites 2 and 3, graphs 2a and 3a

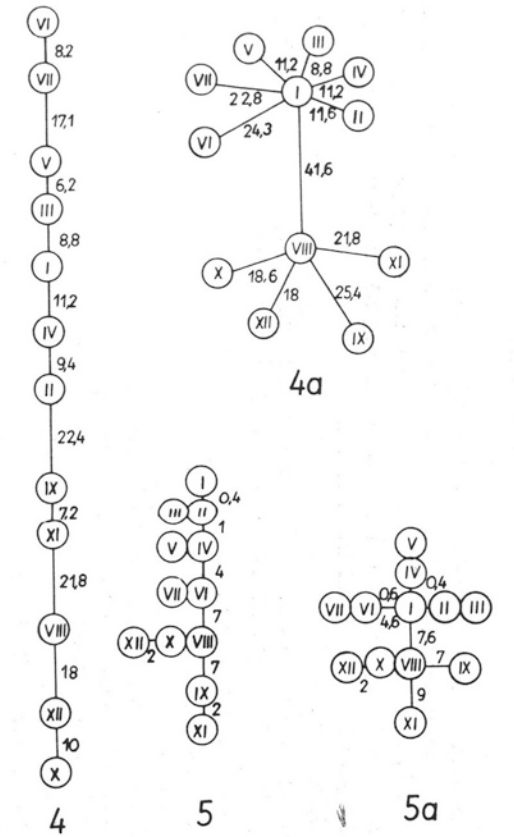

Fig. 3. Dendrites 4 and 5; graphs 4a and 5a

Rola liczby cech przy wyróżnianiu taksonów w badaniach systematycznych prowadzonych metodą dendrytową

Streszczenie

Opierając się na zasadach interpretacji dendrytu opracowanych przez siebie (K o w a l 1965) — autor stwierdza, że konieczne jest wprowadzenie ograniczenia ilości cech, na podstawie których oblicza się wielkości różnic systematycznych dla dowolnego zbioru „indywiduów", gdyż użycie wszystkich znanych cech równocześnie czyni wyróżniane jednostki nierealnymi.

Wykorzystując dotychczasowe osiągnięcia systematyki proponuje przyjąć za podstawę do ograniczenia ilości cech, wyróżniane w systematyce rodzaje, czyli kategorie cech oparte na ich walorach diagnostycznych.

Są one następujące:

A — morfologiczne cechy roślin,
B — anatomiczne cechy roślin,
C — morfologiczne cechy karpologiczne,
D — anatomiczne cechy karpologiczne,
E — cechy embriologiczne,
F — cechy fizjologiczne (fitochemiczne),
G — cechy ekologiczne,
H — cechy genetyczne.

Określenia rangi systematycznej danego „indywiduum" należy dokonywać w oparciu o określoną kategorię cech. Ponieważ jednak różnice między „indywiduami" w poszczególnych kategoriach są różne, za właściwą dla określenia rangi systematycznej należy przyjąć tę kategorię, w której wykazują one największą (z najmniejszych) różnicę systematyczną.

Wyróżnianie taksonów i określenie ich rangi systematycznej należy przeprowadzić według zasad opracowanych dla metody dendrytowej (K o w a l 1965).

Omówione powyżej zagadnienia przedstawia autor na przykładzie badań systematycznych prowadzonych metodą dendrytową, krajowych gatunków rodzajów *Delia* Dum., *Spergula* L. i *Spergularia* Presl.

Opierając się na tabeli cech opracowanej w poprzedniej pracy pt. „A simple way of finding linked and antagonistic characters by means of table of characters used in the dendrite method" autor obliczył różnice systematyczne między gatunkami wymienionych wyżej rodzajów i zestawił je w tablicach Czekanowskiego.

Z tablic Czekanowskiego wykreśla autor dendryty i wykresy odległości od gatunków „typowych" dla ugrupowań zaznaczających się w dendrytach. Za typowe uważa te gatunki, które wykazują najmniejszą różnicę systematyczną ze wszystkimi innymi z tego samego ugrupowania (patrz sumy różnic systematycznych dla gatunków w tablicach Czekanowskiego oraz K o w a l 1961).

Na podstawie tych danych przedstawia autor następujące wnioski systematyczne.

A. Na podstawie kategorii cech A należy wyróżnić:
   a) w rodzaju *Spergula* dwie sekcje:
      1. z gatunkami grupującymi się koło *S. arvensis* (I - V) a nie mającymi rangi gatunków
      2. z gatunkami *S. pentandra* (V) i *S. vernalis* (VII).
   b) gatunek *Delia segetalis* nawiązuje do rodzaju *Spergularia* i nie osiąga rangi oddzielnego rodzaju, dlatego należy wrócić do dawnej nazwy *Spergularia segetalis* Fenzl.

c) różnice systematyczne w obrębie gatunków krajowych grupujących się w rodzaju *Spergularia* są tak duże, że sugerują wyróżnienie taksonów o randze podrodzajów, a mianowicie:
subg. I. (*S. segetalis*),
subg. II. (*S. salina*),
subg. III. (*S. marginata*),
subg. IV. (*S. echinosperma* i *S. rubra*).

W obrębie subg. IV. różnice systematyczne wskazują na istnienie dwu sekcji
1. z gatunkiem *S. echinosperma*,
2. z gatunkiem *S. rubra*.

Gatunkami typowymi w kategorii cech A są: dla rodzaju *Spergula* — *S. sativa;* a dla rodzaju *Spergularia* — *S. echinosperma.*

Dla gatunków grupujących się koło *Spergula arvensis* lepszy rozdział systematyczny uzyskuje się w kategorii cech „C" — gatunkiem typowym jest tu *S. arvensis,* a rangę innych należy obniżyć do: a) podgatunków (*S. linicola, S. sativa* i *S. vulgaris*) i b) pododmiany (*S. maxima*).

Systematyka więc gatunku *S. arvensis* w kategorii cech C przedstawiałaby się następująco:

S. arvensis L.
— — — ssp. I *lincola* (Boreau)
— — — ssp. II *sativa* (Boenn.)
— — — ssp. III *vulgaris* (Boenn.)
— — — *subvar maxima* (Weihe)

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